Weather Bureau, were distributed to all interests in this section. Snow fell during the afternoon and night to a depth of 6 inches, and drifted badly. 27th. Snow ended in the morning, a total depth of 9.7 inches having fallen. Northwest gale all day, with velocities ranging from 40 to 65 miles. All surface cars were obliged to suspend traffic, with the exception of one cable line in New York. Of the railroad lines centering in New York only two, the New York, New Haven and Hartford Railroad, and the Long Island Railroad were blocked. These are nearly parallel lines and were directly in the path of the storm. The tracks were covered, in places, with snow to a depth of 16 feet. Other lines were delayed, but owing to the timely warnings sent out by the Weather Bureau they were enabled to take precautionary measures whereby the delay in moving trains was minimized. Twenty ocean steamers were compelled to anchor in the upper bay, where they remained during Saturday night on account of the snow and gale. The fleet of sound steamers remained at the various docks about 20 hours waiting for the storm to abate.

The following are among many editorial comments made by the daily press regarding this storm, and the action of the Weather Bureau in forecasting its destructive character.

New York Times, December 1, 1898:

In leaving Boston Saturday night the captain of the *Portland* took chances which no man in his position had a right to take. From a source that warranted implicit belief, he, like every other captain on the Atlantic coast, had received warning that a storm of exceptional severity would strike him as soon as he reached open water, and he knew that his steamer, though well built and comparatively new, was of a type much better designed for entering shallow harbors than for encountering winter gales on as dangerous a coast as there is in the world. Despite all this, and, according to his employers, in defiance of implicit orders, he steamed out into the gathering tempest. Why? * * * Perhaps he belonged to the class, once large, but now small and rapidly disappearing, the members of which sneer at the Government Weather Bureau, and prefer to rely on old "signs" instead of on new science as the basis of meteorological prophesy. Perhaps, a score of things. Only this is certain, he should not have sailed, and he should not have been allowed to sail.

The Evening Star, Washington, D. C., November 30, 1898:

The full story of Saturday night's storm may never be told. Its deadly intensity is revealed by degrees in the wreckage which floats ashore, and perhaps in a few days some approximate estimate of the havoc then wrought on the New England coast may be approachable. Meanwhile it is clear that at least one great disaster marked the gale and that many lives were sacrificed. The steamer *Portland* went to pieces some time Saturday night or Sunday morning, so far out of her course as to show that the storm was of resistless strength and that it was the most criminal folly for the captain to put out from port. * * * At half past 10 on Saturday morning the Weather Bureau in this city wired to all its observers along the New England coast the following order:

"Hoist northeast storm signals; east to northeast gales, with heavy snow to-night."

The observers were also directed to warn all railroad and transportation interests of the coming of heavy snow throughout New England. The warning about the snow was particularly important. Often a ship can go to sea with comparative safety in the face of a storm if the air is not clouded, but when the snow is flying landmarks are obscured, lighthouses are useless, and the vessel is left to fate. * * * The *Portland's* captain ignored the official warning [which had been received some eight hours before sailing time], the gale then blowing, the heavy snow then falling, and the direct orders of his superior to keep in port. He carried with him to death over 100 people, who had no knowledge, presumably, of the desperate chances which he was taking. This tragedy serves to suggest that perhaps there may be some more positive method of preventing disasters in the face of solemn warning that danger is at hand. The traveling public ought to have some safeguard against this chance of death. A foolhardy commander should not be permitted to carry out to meet the hurricane his crew and passengers who rely upon his judgment. In many States the owners of ships which are put to sea in the face of the official danger warnings can not recover their insurance money. It may perhaps be possible for the States to go farther and take steps to actually prevent the sailing of vessels under such circumstances. However impracticable such a plan may appear at first glance, the circumstances of the *Portland's* wreck warrant the consideration of any suggestion tending to prevent repetitions of the tragedy.

Mr. William U. Swan, of the New England headquarters of the Associated Press at Boston, has submitted the following report in connection with this storm:

I was on Cape Cod on Tuesday after the storm and talked with many of the life-savers and others who were out in the blow, and they all seemed to agree that nothing so severe has ever been experienced in that part of the country.

The heft of the storm seems to have been about the time or shortly after the center passed over the Cape, which is generally agreed to have been about 9:30 on Sunday morning. The sky at that time over the stretch between Chatham and Barnstable cleared off entirely and the wind died out. Fifteen minutes after it was blowing hard from the north, and it was at this time that the gale wrought the greatest destruction among the trees from Yarmouth to Middleboro. In this respect Sandwich seems to have suffered the most, for not only did the silver oaks, as they are called, go down, but great elms in the town of Sandwich were blown across the streets, and it was a day or two before the main street was passable.

I could not find that the storm center was seen at Provincetown, or anywhere north of Eastham, but from the direction of the wind it seems probable that the storm took a diagonal course over the Cape.

THE LAKE STORM OF NOVEMBER 9-11, 1898.

The severe gale which visited the Great Lakes from the 9th to the 11th was the culmination of ten days or more of severe weather, which was very disastrous to lake marine interests. In referring to the work of the Weather Bureau during this period the Buffalo News of November 13, 1898, remarked editorially, as follows:

The Government Weather Bureau has again demonstrated in the view of all the people of the Lake region its great and growing importance as a factor in the commerce and travel of the inland seas. During the past ten days the Great Lakes have been swept by a continuation of severe storms, the fury of which but few vessels could withstand, although the majority of these vessels are as large, stanch, and seaworthy as any of the ocean liners; yet but comparatively few casualties occurred, which was due to the timely warnings of the Weather Bureau, and it is no exaggeration to say that in this instance alone millions of dollars worth of merchandise, hundreds of vessels, and probably many lives have been saved by the forecasts.

COLD WAVE WARNINGS.

The most important cold wave of the month overspread Montana during the 19th, extended over the upper Missouri Valley, with temperature below zero in Montana during the 20th, and carried the line of freezing weather, with snow and high northerly winds, as far south as Oklahoma during the 21st. By the morning of the 22d this cold wave had reached the western Lake region, the lower Ohio Valley, and the Middle and west Gulf States, with freezing weather as far south as San Antonio, Tex., and by the morning of the 23d it had reached the Allegheny Mountains, and freezing weather was noted as far south as Mobile, Ala. The morning of the 24th the minimum temperature at New Orleans and Mobile was 34° and 30°, respectively. On the latter part of the month continued cold over the eastern half of the country, and freezing temperature was reached along the south Atlantic coast on the morning of the 27th. Full and ample warning of the approach of abnormally low temperature, together with statements of the probable continuation of cold calculated to prove injurious to agricultural and commercial interests was telegraphed to all the districts visited except extreme northern Montana.

CHICAGO FORECAST DISTRICT.

The unusually stormy period in the upper Lake region continued over from October. The "northeaster" of the 9th and 10th was primarily due to the development of an area of high barometer of great magnitude over the Lake region. During the 9th a disturbance developed over the lower Mississippi Valley and moved in a northeasterly course, greatly increasing the force of the gale. Several vessels which had not heeded the warnings of the Weather Bureau were wrecked.

A severe "norther" and cold wave reached the eastern limits of the Chicago forecast district the evening of the 22d. Timely notice of its approach was given in the warnings issued

by the Chicago office and the Central Office at Washington to all States, except a portion of Montana, where its appearance could not be foreseen. Additional warnings were sent to all districts threatened with the advice that the storm and cold wave would be unusually severe. Press reports indicate that large numbers of cattle were saved in the Western States by the warnings, and that other interests were greatly benefited. The gale which attended the severe storm which preceded the advance of the cold wave was very high on the Lakes, and all vesselmen remained in port, except when it was possible for stanch craft to move along the lee shores.—*H. J. Cox, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

No marked or destructive weather changes or conditions were reported in the Pacific coast forecasting districts.

GALVESTON FORECAST DISTRICT.

Mr. I. M. Cline, local forecast official and section director, Galveston, Tex., has submitted the following report in connection with special temperature warnings issued November 21, 1898:

The following warning was issued at 4 p. m.: "Temperature will probably fall to 30° within 100 miles of Galveston and to 42° at Galveston Tuesday."

All sugar planters and truck growers to the coast line were advised over the telegraph and long-distance telephone to protect their crops and they acted without delay. The minimum temperature on Tuesday, the 22d, fell to and below freezing throughout the interior of the State and reached 34.5° at Galveston. Many acknowledgments of the value of the warnings were received, and cane and vegetables to the value of many thousands of dollars were reported saved.

AREAS OF HIGH AND LOW PRESSURE.

During November the paths of nine highs and of fourteen lows were sufficiently well defined to be traced on Charts I and II. On these charts a circle is placed at the position of each center of high or low pressure at 8 a. m. and 8 p. m., eastern time, with the date on the outside of the circle, and the reading of the barometer on the inside. The accompanying table exhibits the principal facts regarding the first and last appearance of the highs and lows, their duration, and apparent velocity.

Highs.—There seemed to be a rather permanent high pressure area on the middle Pacific coast, and some of the highs appeared to originate or separate from this permanent condition. Nos. VII and VIII were first noted to the north of Montana. The general tendency of the highs was along a lower parallel than in October. No. I disappeared in the middle Rocky Mountain region. Nos. III, V, and VII were last seen over Newfoundland, and the rest disappeared off the middle Atlantic coast. The temperature conditions accompanying these highs were quite moderate. On the 8th, as No. IV passed across the middle Rocky Mountain region, there was a fall of 30° in twenty-four hours at Denver in the morning, and of 34° in the evening at Pueblo. The severest cold wave of the month accompanied high area No. VII, and in this area the highest absolute barometer readings of the month were noted. On the evening of the 20th Denver experienced a fall in temperature of 50° in twenty-four hours, and to 12°. On the morning of 21st Denver reported a fall of 54°, and to 4°. On evening of 21st the cold wave had moved rapidly eastward, Springfield, Mo., experiencing a fall of 52°, and to 12°. The next morning the same station reported a fall of 44°, and to 12°. On evening of 22d Chicago reported a fall of 42°, and to 14°, and Cincinnati had a fall of 42°, and to 22°. On morning of 23d Columbus and Cleveland reported a fall of 36°, and to 20° and 18° respectively.

Lows.—The month was very prolific in low areas, no less than fourteen having been charted. Nine of these began to the north of Montana; one, No. XI, in the Red River Valley; Nos. IV and VI in Arizona; and X and XIV on the south Atlantic coast. The general track of these lows was along the north border of the United States, and ten of them were last noted off Nova Scotia or over Newfoundland. No. XIII was last seen in Ontario. Nos. V, XI, and XII in the Red River Valley, and VI in the central Gulf.

The highest winds of the month were reported as follows: As storm No. II approached Lake Superior, afternoon of 4th, a south wind of 60 miles an hour occurred at Chicago. As the same storm passed the lower Lake region it caused a west wind of 68 miles at Buffalo. On the afternoon of 11th, as IV passed to the north Atlantic coast, it caused a northwest gale of 56 miles at New York City. On the afternoon of 21st, as No. IX approached Lake Michigan, Duluth experienced a northwest wind of 52 miles, and Grand Haven the same velocity from the southeast. On the evening of 26th, as storm No. XI passed up the middle Atlantic coast, Block Island reported a northeast wind of 60 miles and accompanying the same storm the next morning Hatteras and New York City reported a northwest wind of 56 miles, Sandy Hook a northeast wind of 60 miles, Boston a north wind of 56 miles, and Eastport a northeast wind of 56 miles.—*H. A. Hazen, Professor.*

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	*31, p. m.	43	127	2, p. m.	39	106	1,210	2.0	605	25.2
II	3, p. m.	37	124	8, p. m.	37	75	3,540	5.0	708	29.5
III	6, p. m.	41	126	10, p. m.	48	55	3,720	4.0	930	38.7
IV	7, p. m.	43	123	14, a. m.	41	69	3,060	6.5	471	19.6
V	11, p. m.	43	120	18, a. m.	47	56	4,260	6.5	655	27.3
VI	15, p. m.	42	121	21, p. m.	36	73	3,070	6.0	512	21.3
VII	18, p. m.	54	117	26, p. m.	47	61	3,480	8.0	435	18.1
VIII	23, p. m.	52	108	29, a. m.	38	73	2,430	5.5	442	18.3
IX	26, p. m.	42	116	30, p. m.	31	78	3,030	4.0	757	31.6
Total							27,800	47.7	5,515	229.6
Mean of 9 paths							3,089		613	25 5
Mean of 47.5 days									585	24.4
Low areas.										
I	*29, p. m.	47	125	2, p. m.	48	66	3,030	4.0	757	31.6
II	1, p. m.	55	118	7, p. m.	47	54	3,480	6.0	580	24.2
III	6, a. m.	52	120	8, p. m.	49	69	2,580	2.5	1,032	43.0
IV	7, a. m.	32	114	11, p. m.	48	59	3,480	4.5	580	24.2
V	9, p. m.	55	114	11, a. m.	52	96	780	1.5	520	21.7
VI	10, p. m.	34	114	13, a. m.	29	93	1,290	2.5	516	21.5
VII	11, p. m.	53	113	14, p. m.	49	55	2,670	3.0	890	37.1
VIII	16, p. m.	53	118	20, p. m.	47	56	3,270	4.0	817	34.1
IX	18, a. m.	51	123	23, p. m.	42	67	3,050	5.5	555	23.1
X	23, a. m.	34	76	25, p. m.	46	58	1,350	2.5	540	22.5
XI	24, p. m.	49	99	29, a. m.	44	58	2,880	4.5	640	26.7
XII	25, p. m.	52	116	27, a. m.	52	97	810	1.5	540	22.5
XIII	27, a. m.	52	122	30, a. m.	47	81	1,830	3.0	610	25.4
XIV	29, a. m.	31	80	†1, p. m.	44	60	1,890	2.5	756	31.5
Total							32,390	47.5	9,383	389.1
Mean of 14 paths							2.314		667	27.8
Mean of 47.5 days									682	28.4

* October. † December.

RIVERS AND FLOODS.

The annual rise appears to have set in during the latter half of the month, except in the Missouri and upper Mississippi rivers, where steady rises are not the rule during the winter season. The Ohio and its tributaries were the first to rise, the crest of the highest water reaching Parkersburg on the 14th, Cincinnati on the 17th, and Cairo on the 20th, and thence extending down the Mississippi. The highest waters